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The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A TRANSATLANTIC CLIPPER SERVICE.

A lover of the sea has been prompted to write to the daily press, suggesting, in all seriousness, that it would be a profitable and popular move on the part of our leading steamship companies if they were to add to their fleet one or two passenger sailing ships, with a view to affording those passengers who take the transatlantic trip purely for health and pleasure, an opportunity to spend more days upon the ocean than they can enjoy in a trip between America and Europe on a fast, modern steamship. At the first blush, the suggestion that we should return to the leisurely speed of the clipper sailing ship, seems almost preposterous; and yet on second thought, when we bear in mind the wonderful growth of the yachting spirit, as shown by the vast fleet of sailing yachts and steam yachts that covers our waters in the summer season, the idea is by no means visionary; and, indeed, if put into effect to a limited extent, it would probably prove to be a very successful venture. To a large and ever-growing percentage of European travelers, the sea voyage is one of the greatest inducements to make the trip. With all our vaunted advance in speed and comfort, there is a question whether we have not sacrificed many of those very features of a sea voyage which tend to give rest to mind and body. The great demand for space for engines, boilers, and coal bunkers has made it necessary to cut down the stateroom accommodation to absurdly narrow limits—so narrow that not the most elaborate furnishings and finish can disguise the fact that the average stateroom is not much more than a stuffy little box in which one is veritably "cribbed, cabined, and confined." The compensation for many travelers is to be found in the short duration of the passage, and for those to whom time is an object, either for business engagements or to escape the inevitable miseries of seasickness, the cramped quarters are regarded as part of the price which must be paid for high speed. If a clipper sailing ship, however, were designed especially for transatlantic summer travel, it would be possible, in the absence of any provision for steam power or cargo, to give up practically the whole ship to passenger accommodation, and individual staterooms could easily be made double the size of those usually found on the modern liner. There would be a complete absence of vibration, and of smoke and cinders, and a general steadiness of motion which only those who sail the seas under canvas can properly appreciate. If the ship were built with modern speed lines, it should be able under favorable circumstances to make the eastward passage in from twelve to fifteen days. The westward passage would, of course, take longer; but as the travelers on such a vessel would be taking the trip largely for the sake of the sea voyage, a three or four weeks' journey would be looked upon rather with favor than with regret. Such a vessel would be fitted with every luxury that is to be found on the modern liner, and the absence of engine-room skylights and smokestack openings, would render it possible to provide magnificent promenades extending the full length of the vessel and almost entirely free from obstruction. The experiment is surely worth a trial on the part of one of the more wealthy companies; for it would be somewhat in line with that most successful venture of the German companies, in building steam yachts of slow speed exclusively for yachting cruises of many weeks' or months' duration.

WIND RESISTANCE IN HIGH-SPEED TRAIN SERVICE.

Just now the most interesting development of electric traction is its invasion of a field which was supposed to belong exclusively to the steam locomotive—that of long-distance interurban service. The success that has already been achieved in such service on the lines already built is naturally leading electrical engineers to consider the possibility of maintaining a regular long-distance service at speeds equal to those of the steam railway. Before such a competition can be successfully carried out, however, there are certain important elements of the problem, other than those of a strictly financial and commercial character, that must be fully recognized; and, perhaps, the most important of these is the question of wind resistance at high speeds, say of 40 miles an hour and upward. In a series of trials carried out two or three years ago on the Buffalo & Lockport electric line of the International Railway Company, it was proved that at the higher speeds it requires much more power per ton to drive a single car than it does per ton to drive a train of cars. Thus, it was found that whereas a train made up of several cars required a consumption of 47 watt-hours per ton per mile for a sustained speed of 75 miles per hour, if one of these cars were detached and run over the same track under the same conditions at the same speed of 75 miles per hour, the consumption of energy rose to 137 watt-hours per ton per mile. That is to say, at the given speed a single car requires 2.9 times the expenditure of energy per ton that is necessary for the same car if it forms one of a train of several identical cars. Now, assuming that the track, the weather conditions, and the speed were the same for the single car as for the several-car train, the engineers who made the tests were justified in their conclusion that the increased power necessary in the case of the single car was due almost entirely to air resistance. In other words, the work done by the car running alone and by the same car running in the middle or at the tail end of a train of cars was the difference, to borrow from bicycle parlance, between the work done at a given speed by a rider unpaced and by the same rider when he is behind the shelter of a pacing machine. That this view of the case is correct, is further borne out by the fact that the coupling of only two identical cars for a run at 75 miles an hour, showed that only 92 watt-hours per ton per mile were necessary, as against the 137 watt-hours required by a single car. This fact presents us with another parallel to bicycle conditions; for all of us who have ridden a tandem are well aware that, where two riders may be unable to make much headway against a strong gale of wind when they are riding separate wheels, they can make good speed if they couple up for united effort on a tandem. As a matter of fact, on level roads and a well-made track, by far the most serious element of resistance will be found to be the inertia of the air, and the higher the speed, the greater will be this resistance. The front face of a moving car has to open a path for the vehicle, and set the surrounding envelope of air through which it passes more or less in motion in its own direction. The car immediately behind it has no such head resistance to encounter, and is simply affected by the sliding friction ("skin friction" it would be called in considering the case of a sailing vessel), and, of course, the surplus power of the car is thus available to assist the leading car in overcoming the head resistance. Consequently, it follows that the longer the train, supposing the cars to be similar in weight, form, and power, the greater is the power available against head resistance and the less the expenditure of energy per car necessary to maintain a given rate of speed.

This fact will, of course, exercise a powerful influence in determining the character of future high-speed, long-distance electric service; and, where each car is a separate self-propelled unit, its tendency, because of the economies secured, will be to induce the companies to operate trains made up of several cars at long intervals, rather than run individual cars at more frequent intervals. The latter system would be the ideal one for the convenience of the public; but the cost, because of the larger amount of power that would be necessary, would probably render it impossible for the electric companies to compete successfully with the steam railroads. It must be understood that these considerations apply only to high-speed service; for up to speeds of 30 miles the difference in power required per ton per mile in running cars singly and in trains is so inconsiderable as to present no serious objection from the standpoint of economy to the operation of single-car service.

Another question to which proper attention has never yet been given, whether in steam railroad or electric railroad service, is that of the superelevation of the outside rail on curves. It is true that of late years engineers of maintenance of way on steam railroads have been showing a more intelligent appreciation of the necessity for superelevation; and on certain eastern roads where a high-speed service is to be maintained over a track with heavy curvatures, superelevation has been carried as high as 8 inches, with the very best results in safety and comfort of operation. Eight inches of elevation, however, is not by any means the maximum possible, and there is no physical reason why a train should not be run at 60 miles an hour around a 10-degree curve, provided the outer rail were elevated to the point at which the pull of gravity toward the inside rail balanced the centrifugal pull toward the outside rail. The trouble on steam railroads is that it sometimes happens that a slow passenger or freight train may, through the exigencies of traffic, be obliged to run at a low speed over the highly superelevated express tracks, and in such a case the component of gravity might be so far in excess of the centrifugal force that loaded freight cars with a high center of gravity would be in danger of capsizing to the inside of the track—and this has actually happened on some eastern roads. But on the high-speed electric road of the future, it will be absolutely necessary to take special precaution in the way of fencing in the tracks, and enforcing a very rigid observance of the block signal system; and these precautions will have to be arranged so that no train will have to slow up or stop upon any of the sharper curves. With the certainty that the electric train will be running at its maximum speed on such curves, it will be possible to give extreme superelevation; and by laying out the curves on what is known as the spiral system, where the curve commences with a one-degree curve and runs up by gradual increments to a maximum of 10, 15, or 20 degrees, as the case may be, it will be possible to maintain a 75-mile service with safety on the necessarily tortuous location on which many electric lines will have to be built.

PREHISTORIC DRAWINGS OF ANIMALS, ETC., IN THE CAVE OF ALTAMIRA, SPAIN.

Messrs. Emile Cartailhac and H. Breuil recently presented a paper to the Académie des Sciences relating to the discoveries which have been made in the cave of Altamira in the province of Santander. This cave was remarked in 1880 by M. Santuola as containing numerous debris of habitation and industry of the stone age, with paintings or drawings in red and black which represented various animals with great originality. At that time these cave drawings were the only ones which had been discovered, but in the last few years the discovery of several caves of the same kind in France has shown that the ornamentation of caverns by line drawings and paintings at an epoch as ancient as the quaternary is a question which should be carefully studied, and each new find will throw fresh light on the subject.

For this purpose Messrs. Cartailhac and Breuil made a trip to Spain and examined the cave very carefully during a month or more. The region is formed of cretaceous limestone and its aspect shows a considerable underground water circulation. In many places the cave has fallen in, especially in the front part, which is thus opened for a length of 800 feet. A series of narrow galleries branch off from the main cave. One of these is 150 feet long. The traces of prehistoric habitation are numerous, especially near the mouth of the cave. Here are to be seen most of the frescoes and drawings, which at first are almost all on the roof of the cave, and extend clear to the back. Their distribution is unequal and somewhat remarkable. Numerous small characters or signs drawn in black, and formed of points and lines, are to be seen only in the farther galleries and distributed without any order or appreciable significance. Five complicated figures drawn in black are observed side by side in the end of the last gallery. They have a certain analogy with the geometric decoration which is seen on the long Australian shields, made up of lines in a varied design. Numerous animal drawings are observed in all parts of the cave. Some of these are in black, generally of small size, 20 or 30 inches high, and are often indicated by a simple outline. Others are drawn in red dotted lines or in a broad line and are better executed, especially in the front cave.

Some of the most remarkable drawings are found superposed upon the former series and are consequently more recent; the latter are of larger size and have the appearance of frescoes. The exactness of the proportions and the correctness of the outline leaves but little to be desired. This perfection in the drawing is seconded by a good technique and the utilization of all the tints and effects which can result from a mixture or juxtaposition of red and black. The outline of the animal has been generally traced beforehand by a series of light scratched lines, in which the drawing of the feet, the eyes, nostrils, and horns is most noticeable. These large drawings, from 4 to 8 feet high, are distributed over a ceiling 140 feet long by 35 feet wide. Often the natural relief of the stone and its projections, which are sometimes large, has determined the choice of the place and the character of the drawing, so that the whole or a part of the animal has the appearance of a colored relief. The animals are represented standing, running, or lying down, and their attitudes are correct as well as singular. Among the fresco drawings are noticed the Bovidæ, with the bison in the majority, also the wild boar, horse, deer, and others. In the line drawings the deer's head is the most numerous, also the wild boar, and a very fine deer's head with the horns well drawn. On the ceiling around the animal drawings are noticed a great number of curious red characters, and these seem to have a certain significance. Other signs which are drawn in scratched lines, form a second class. These seem to indicate huts or dwellings made of branches of trees. More than 20 of these are seen in the first chamber. Near them are some silhouettes of the human figure of a primitive design and rather vaguely sketched, but they are remarkable for certain details which will form an interesting study for comparative ethnography. The gesture of the arms seems to indicate that of a suppliant.

As concerns the drawings, there is evidently a connection between those which are observed in the Altamira cave and those of the six caves which have been already discovered in France. The technical processes are about the same, and the same idea predominates in all, but the Altamira drawings are far superior in all respects. The fauna which is represented here does not show, like those of the Gironde, Dordogne, and Gard caves, different extinct species such as the mammoth, nor is the reindeer to be seen. But the same is to be noted in the case of the intermediate cave of Marsoulas. The species peculiar to the cold period of the quaternary, while proceeding in a southerly direction, do not descend as far south as the latitude of Altamira.

M. Salomon Reinach makes the interesting observation that the animals which are represented in these cave drawings are all herbivoræ, and there are no carnivoræ among them. These animals are, therefore, of the class sought for by the cave dwellers, who were hunters and fishers. The fact that these were the only ones to be drawn seems to show that the object of the primitive artists was to exercise a magic attraction upon these animals. The natives of central Australia also have the habit of drawing figures of animals on the rock or the ground, with the idea of increasing the breeding of such animals, and the carnivoræ are excluded from these drawings, as this would bring bad luck. The drawings observed in the caves of the Reindeer epoch seem to have an analogous character. They were not drawn in the leisure hours of the hunter simply for his amusement, but were talismans by drawing which he expected to have an increased game supply. During this very ancient phase of human evolution, religion (in the modern sense) did not as yet exist, but magic played an important part and was associated with all forms of human activity. M. Reinach adds that according to a letter from Prof. Frazer, of Cambridge, certain facts which were brought from Australia by Messrs. Spencer and Gillen, and which are as yet unpublished, serve to confirm this opinion.

THE GANZ SYSTEM OF ELECTRIC CANAL HAULAGE.

With the Ganz system of electric haulage, a monorail track is used, and this largely accounts for the low first cost of construction, while the lightness of the locomotive used in proportion to its output, occasioned by peculiar construction, undoubtedly has much to do with the excellent showing as to working cost per ton-kilometer. The Ganz tow locomotive was designed by Engineer Fabre, and two inclined pairs of axles are provided, instead of the ordinary horizontal axles usually employed with two vertical wheels.

In the construction of this locomotive there is an inclined wheel on every axle, and each pair of wheels embraces the rail head. Since there is only a single rail, another lateral wheel is provided to brace and steady the locomotive, this wheel operating upon the ground or towpath. By the inclined wheel arrangement, the rope pull is utilized to increase the adhesion, and it is also claimed by the engineers favoring this system, that the adhesion is still more increased by the wedging action upon the inclined axles, due to the weight of the tow locomotive.

The locomotive was designed for a three-phase current, the motor operating with current of a frequency of 50 periods per second; and on account of the high speed of the motor and the low speed of the locomotive, spur reduction gearing was employed. It is stated that at 15 periods per second, this reduction gearing would not be necessary, and the motor shaft could be direct connected to the worm gear driving shaft. Mr. Szasz gives the following as the fundamental qualities of this locomotive:

1. With the use of one rail, a very high coefficient of adhesion, and consequently a very light-weight locomotive. 2. The utilization of the tow rope for the increase of adhesion of the locomotive. 3. Proportional increase of the stability of the locomotive according to the effort put forth. Continuing, he gives the following data in reference to this locomotive:

"It rests upon one rail only, which differs little in shape from the ordinary Vignoles rail. The two oblique pairs of wheels embrace the lateral and top parts of the rail head, a little room being left on the top. The weight of the locomotive rests upon the four oblique axles, being carried on one side by a spring. The motor shaft is disposed horizontally, the motor being built into the locomotive frame. Each of the four axles is driven by the worm gearing by means of two endless screw shafts, which are operated from the motor by a spur gear. The lateral broad supporting wheel serves the purpose of bracing the locomotive and thereby insuring equilibrium. This wheel is fixed on the side facing the canal, as the inclined towrope tends to tip the locomotive in this direction. If the locomotive represented a rigid system, the force of reaction on the rails causing the adhesion could only be as great as the weight of the locomotive itself, apart from that small part of the weight taken up by the wheel. As the adhesion is to be increased by the wedging action of the weight, it has been necessary to provide for a certain mobility in those parts by which the weight of the locomotive is taken up and transmitted to the rails. For this purpose the locomotive weight can be shifted on the axles. The bearings of only two axles are rigidly built together with the motor, these two axles being on the same locomotive side. The axles on the other side are able to turn round the endless screw shaft, and the locomotive weight rests on this side, by means of springs on the axle. In this way the relative position of the axles and the motor can be shifted in axial direction, and besides the axles of the one side can move around the shaft. This mobility of the axles enables the weight to develop the wedging action."

The Ganz locomotive for towing in the electric system of canal haulage has a controller, a rheostat, main switch, and plug contact for manipulating the three-phase motor. The current is directed to the motor through a flexible cable and trolley contacts, the rail being used as the third conductor. The overhead line consists of two copper wires .314 inch diameter, and the pressure used is 500 volts. The two contact wires are located 11.8 inches apart, and are placed 19.6 feet from the ground. The two conductors are supported on wooden poles placed about 100 feet apart.

"HOME MECHANICS FOR AMATEURS."

Doubtless many readers of the SCIENTIFIC AMERICAN, and all readers of "Experimental Science," will be gratified to learn that the late George M. Hopkins left a posthumous work, to which special interest always attaches. It is not always, however, that a work of this character possesses equal merit with one entirely completed before the death of the author. As a rule, such work has not had the advantage of the final perusal and correction by the author. Such has not, however, been the case in the present instance, for "Home Mechanics for Amateurs" was completed before the author's death. The present volume contains much matter which has never before appeared in print, and some articles which have already been published in the SCIENTIFIC AMERICAN. The work will furnish abundant food for thought for the amateur, and will give him suggestions whereby he may pass many pleasant hours in his workshop. Mr. Hopkins was an expert mechanic, and one of his chief pleasures was to make experiments at his home in his well-equipped workshop and laboratory. The work described in the present volume is nearly all the result of experiments made by him during such idle hours. It was the intent of the author to make the present work as suggestive as possible. No complicated aparatus is required in carrying out the experiments described. Anyone with ordinary mechanical ingenuity, having a lathe and a few tools, can make most of the articles and try the experiments illustrated and described in the 370 pages of the book. It deals with Woodworking, How to Make Household Ornaments, Metal Work, Model Engines and Boilers, Home-made Meteorological Instruments, How to Make Telescopes and Microscopes, Batteries, Electric Lights, a New Electrical Cabinet, Electric Motors and Dynamos of Various Kinds, an Electric Furnace, a Recording Telegraph for Amateurs, and How to Make a Telephone. The book is profusely illustrated with 326 illustrations. It is hoped that "Home Mechanics for Amateurs" will prove helpful to as many thousands as has "Experimental Science."

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1452, contains the usual variety of instructive articles. Mr. Frank C. Perkins presents an illustrated account of the use of electricity on Alpine railways. The use of the Parsons steam turbine in steamships is a probability that is discussed at length. A simple method of finding the capacity and horse power of pumps is outlined. The Eisemann and Bosch systems of electric ignition are described and clearly illustrated. Mr. Alfred Hands, in an excellent paper, enumerates some safeguards against lightning. Prof. Robert H. Thurston concludes his thoughtful paper on the "Functions of Technical Science in Education for Business and the Professions." J. M. Macfarlane has much to the point to say on the relation of science to common life. The Demeny contour indicator is described and illustrated. An article on the self-electrification of radium will doubtless be received with interest. How a lecture-room thermometer can be made is told in a very instructive article. The usual trade, electrical, and engineering notes are also published.

SCIENCE NOTES.

It has been stated by an eminent authority that the cyanide process "has done more than all other recent processes combined for cheapening the production of various metals, increasing the gold supply of the world, and advancing the standard of our progress and civilization."

The first recorded attempts to apply cyanide to ore treatment were by an inventor named Simpson, of Newark, N. J., who patented a process in 1885, followed by a process patented by Jules Rae, of Syracuse, N. Y., in 1887. The first really successful cyanide process applied on a large scale was that introduced by the McArthur-Forrest patent of the same year.

Curator Lucas of the National Museum, who went to Newfoundland a couple of months ago to obtain a plaster cast of a whale, has succeeded in his task. The cast is said to be the largest in the world, and when completed will be shipped to the museum. Later it will be duplicated and a replica sent to the St. Louis Exposition. It is seventy-nine feet long.

Definite words are necessary, says Engineering Record, for the expression of definite ideas. Hence scientific terms have to be employed. A term has one definite meaning which does not change with time. The rush of affairs drifts words from their original meanings, as ships drag their anchors in a gale, but terms sheltered from common use hold to their moorings forever. The word *let*, for example, has drifted in two hundred years from meaning *hinder* until now it means *permit;* but the term *bisect* has remained unaltered in significance for centuries.

Since the American occupation of Cuba, yellow fever is gradually being eradicated. This remarkable sanitary change is due partly to the explosion of the old superstitious beliefs by the army surgeons and partly to a systematic extermination of the mosquito. Dissipating the common notion that yellow fever is a deadly filth disease, highly contagious, our army experts showed that yellow fever could be spread, and was actually spread, by the mosquito. Attempts at the extermination of the mosquito in Cuba have borne such fruitful results that it can hardly be questioned that in time the leading Cuban cities will be as free from yellow fever as our Southern ports.

The recent announcement of a mosquito destroyer is commented upon in Popular Science Monthly in no very uncertain terms. It is pointed out that the original paper published in Bulletin 13 of the Public Health and Marine Hospital Service hardly justifies the newspaper claims which were made for it. Dr. Stiles, the author of the investigation, simply discovered a new parasite of the mosquito, several of which were already known, and pointed out that these organisms might be of value in holding in check the mosquito plague. There are many technical difficulties in the way of a practical utilization of these "destroyers," and there was in the original article no intimation that the Public Health Service is breeding the germs in order to infect mosquitoes.

Charles E. Bessey of the University of Nebraska writes to Science of a cedar which he claims to be over one thousand years old, as follows: "In the Garden of the Gods, near Pike's Peak, Colorado, there are many large specimens of the brown cedar, *Juniperus monosperma* (Engelm.), Sargent, and in a recent visit to that place it occurred to the writer that these trees must be very old. On the 13th of August he was fortunate enough to find the stump of a recently-cut tree, on which it was easy to distinguish the annual growth-rings. These were counted for a section of the trunk, care being taken to select a portion in which the rings were of average thickness, and on this basis the number for the whole stump was calculated. In this way it was found that this particular tree was between eight hundred and one thousand years old. In other words, this tree was a seedling some time between the years 900 and 1100 A. D."

W. S. Hendrixson has studied the behavior of finely divided silver toward substances that readily give up oxygen such as chromic, chloric, bromic, iodic, and permanganic acids. In all the experiments silver was precipitated from an alkaline solution of silver oxide by formalin and afterward carefully purified. Both chloric and iodic acids are capable alone of oxidizing large quantities of finely-divided silver. Both acids react quantitatively upon silver, with the result that a molecule of the acid is completely reduced, and six atoms of silver are oxidized, one of which forms a halide, and five form silver chlorate or iodate. Bromic acid reacts in a similar manner. Dilute sulphuric acid alone is incapable of dissolving finely-divided silver, and the seeming solvent action is due to the oxygen of the air, oxygen dissolved in the acid, or to that derived from some external source. In the near future an attempt will be made by the author to ascertain whether, by excluding extraneous oxygen, the actual oxidizing power of a bichromate solution may not be very accurately determined with silver.